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Team 13: Modelling Technical Aspects of NCO (Convoy Protection)

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INTRODUCTION

The German Federal Office of Defense Technology and Procurement has been analyzing the influence of networked sensors and effectors on military capabilities. The background of our overall scenario is peace support operations (PSO) in an urban environment. The background for the actual technical evaluations of sensors, effectors and the connecting network is the following scenario vignette: Convoy Protection.

The forces at a sanctuary in the center of a city are supplied with fuel, ammunition and food transported by a convoy running from the headquarters, located at the airport. This convoy is protected by:

- Two check points as flank protections
- UAV, UGV
- AWC (Wiesel)
- LIV (Fuchs)

Evaluation of the Ground Picture: The convoy leader is connected to the mission cell at his headquarters and as well to the leaders of the check point. He can react on information received from the UAV and UGV on possible trafficability of the pre planned route. Detours are possible.

There is an asymmetric threat: A local burning obstacle brings the convoy to a stop. Mobile barriers in an ambush, snipers and bazooka shots are looking for an opportunity to intercept the convoy.

The MOE's are:

- the delivery time and
- BLUE casualties.

The technical effects of special sensors and effectors at the convoy and his NCO capability will be examined. The basic implementation of the scenario in MANA was the task during PAIW 12. The challenge of modelling was the level of detail.

The simulation tool in IDFW 14 will be MANA, again, in spite of our realization of the limitation of the tool MANA in this scenario. The experiment design will follow the NOLH design and possibly a mixed NOLH/Grided Design. The idea is to follow a three step approach:

- Step 1: using existing equipment (sensors, effectors)
- Step 2: using equipment under development (sensors, effectors)
- Step 3: using future equipment (sensors, effectors).

Variations will be investigated in the technical representation of UAV / UGV speeds, communication and sensors, in scenario details and in a variation of protection and equipment.

For the planned investigations three scenarios were prepared. Two of them differ in the distance between the vehicles. In one we took 50 meters and in the other we took 10 meters (which is more usual for the German Bundeswehr). These two scenarios have to

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be assigned to the mentioned Step 2 because a UGV or a UAV are not introduced to the forces yet.

The third scenario belongs to Step 1. Here we replaced the reconnaissance-devices by just the human eye. A vehicle of the escort drives up to the junction, checks the surrounding area and triggers the convoy depending on the observed.

Step 3 was partly covered by a corresponding choice of the intervals for the parameters in the DoE. Modifications of the scenarios due to step 3 could not be made because of the shortness of the workshop.

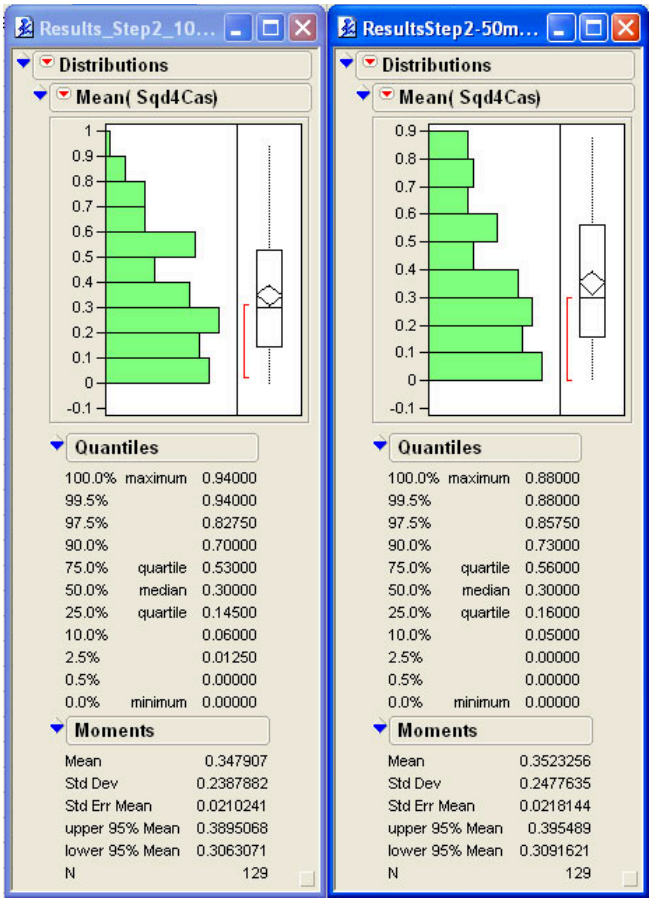

Figure 1

The first series of experiments was made in vain. We started with the DoE which we already used for IDFW13 in Scheveningen. There we intended to investigate the most important parameters of the sensors, the convoy, the network and the irregular forces. We extended that design by the "concealment" attribute of the terrain, the "stealth factor" of the irregular forces and the "number of hits to kill" of the supply vehicles. The "concealment" attribute is an element of the unit interval [0,1]. OldMcData and/or the Tiller could not handle these values and rounded them to zero. So the experiments were conducted without concealment. That wasn't our intention.

From the next series of experiments we learned the different distances between the convoy's vehicles don't have a significant influence on the MoE. You can observe this outcome for example in the following picture (Figure 1) where the distributions of the casualties of the first supply vehicle are compared.

On the left-hand side we see the corresponding distribution of the 10m – scenario and on the right-hand side the one of the 50m-scenario. They are almost the same. The mean and the other empirical values are almost the same. Therefore we decided not to consider the 50m – scenario in the following experiments.

The tactics of the irregular forces were modeled the following way. They shoot at the vehicles when they see fit. The next picture (Figure 2) shows the street with the ambushing red forces. The two soldiers at the lower and the upper end of the street are the bazooka shots. It is obvious that the modeled tactic is not an efficient tactic. Therefore we changed it. For the next experiments the red forces stay covered until the bazooka shot at the upper end of the street opens fire by shooting at the leading vehicle. Then the others will shoot when they see fit.

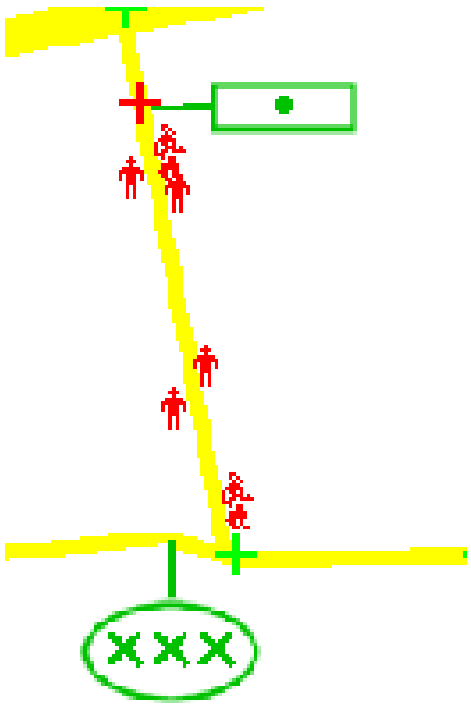

Figure 2

With the next pictures we will see the differences in the outcome of the experiments with the Step2-

scenario. The following picture (Figure 3) shows the distributions of the casualties of the four supply vehicles with the old tactic of the red forces.

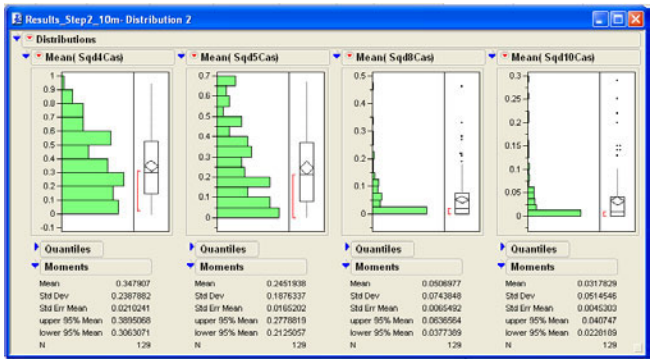

Figure 3

The next picture (Figure 4) will show us the consequence of the new tactics.

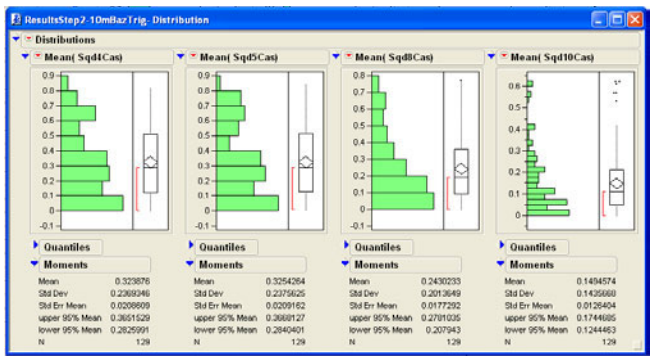

Figure 4

Especially the two distributions on each right-hand side are very different. The mean of the casualties of the first tanker rises from 5 % to 24 %!

Finally we will have a short look at the comparison between Step 1 and Step 2. The results as far as the fight is concerned will not be different because there are no differences in the modeling. The only difference that can be expected is the performance of the reconnaissance.

The picture (Figure 5) shows the distributions of the casualties of the indicator agent for the original route. The means are the probabilities of detection. On the left side we see Step 1 with the probability of detection of 2%. On the right side the probability is 31 %. That means quite an improvement.

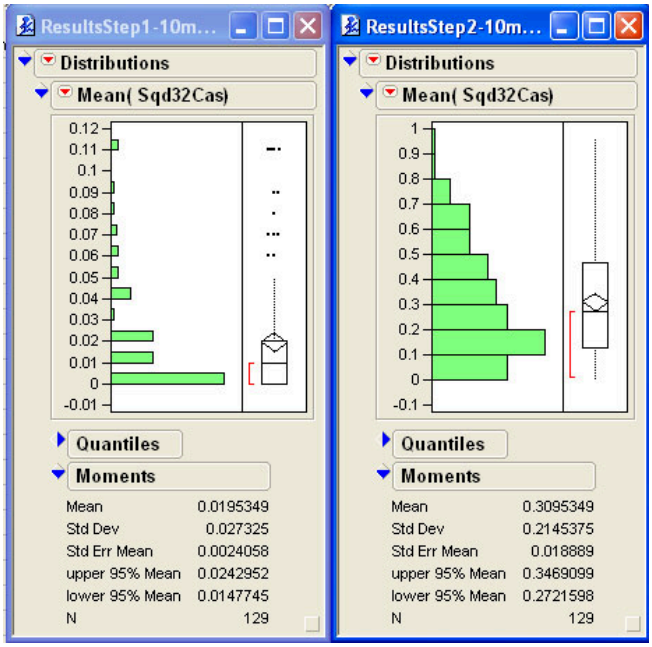

Figure 5

Unfortunately it was not worth to go into deeper comparisons. We observed in the results that the scenarios especially the one of Step 2 didn't work correctly. Almost one third of the results were wrong. We saw it by comparing the casualties of the leading vehicle and the number of arrivals at the mosque.